Meeting Agenda

Carlsbad Desalination Project – NPDES Permit Development Update

Date and Time

Wednesday, January 31, 2017
9:00am-12:00pm

Location

California Regional Water Quality Control Board, San Diego Region
Third Floor Library
2375 Northside Drive, Suite 100
San Diego, CA 92108

Teleconference

Phone number: 888-808-6929 or 213-787-0529
Access code: 2535683

Webex Link:

https://join.me/PW_CB_Office

Meeting participants

Entity	Staff
Poseidon, LLC	Peter MacLaggan Josie McKinley Craig Johns (by phone) Kelly Huffman (by phone) Michael Welch Tim Hogan Chris Stiedemann
San Diego County Water Authority	Robert Yamada Toby Roy Jeremy Crutchfield
San Diego Water Board	David Barker Brandi Outwin-Beals Ben Neill Dan Connally (USEPA contractor, by phone)
State Water Board	Claire Waggoner (by phone) Kim Tenggardjaja (by phone) Daniel Ellis (by phone) Renan Jauregui (by phone) Phil Wyels (by phone) Marleigh Wood (by phone) Catherine Hagan

1. Introductions

2. Intake Alternatives

3. Proposed Zone of Initial Dilution (ZID)

4. Marine Life Impacts Associated with a Diffuser (vs with Current Outfall)

5. Mitigation

   - Calculation of Area within the BMZ

   - Proposed Mitigation Ratio for Brine Mixing Zone (BMZ) Impacts

6. Schedule Update

   - Deliverables from Poseidon

   - Permit Development

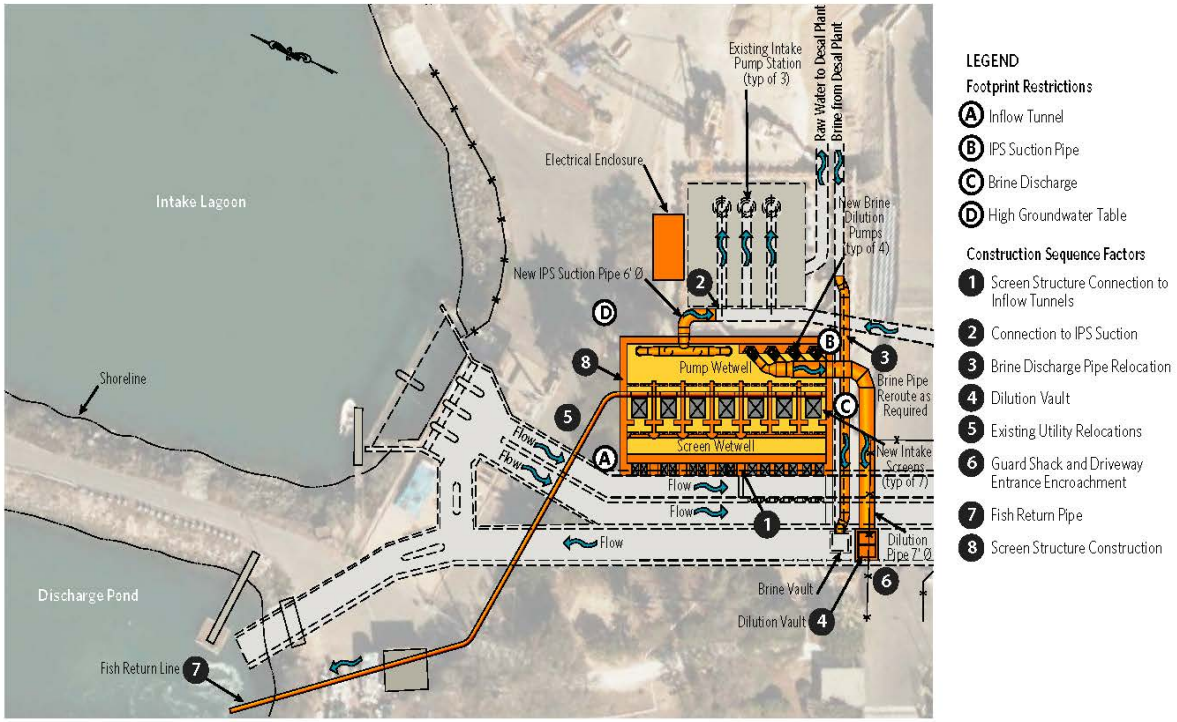
7. Additional Discussion

CARLSBAD DESALINATION PROJECT
PERMIT RENEWAL MEETING
JANUARY 31, 2017

Discussion Topics

1. Analysis of alternative intake screen locations
    a. Scope and configuration of improvements
    b. Cost
    c. Schedule
    d. Environmental impacts
    e. Fish return to lagoon
2. Ocean Plan intake velocity requirements
3. Zone of Initial Dilution
4. Mitigation and climate change
    a. Method for Determining Diffuser Mitigation
    b. Area within the BMZ
        i. Soft bottom area 2017 and 2065
        ii. Hard bottom area 2017 and 2065
    c. Wetlands restoration Project area
        i. Intertidal area 2018 and 2065
        ii. Subtidal area 2018 and 2066
    d. Effect of Sea level Rise on BMZ Mitigation Area

ANALYSIS OF ALTERNATIVE SCREEN LOCATIONS – CONFIGURATION OF IMPROVEMENTS

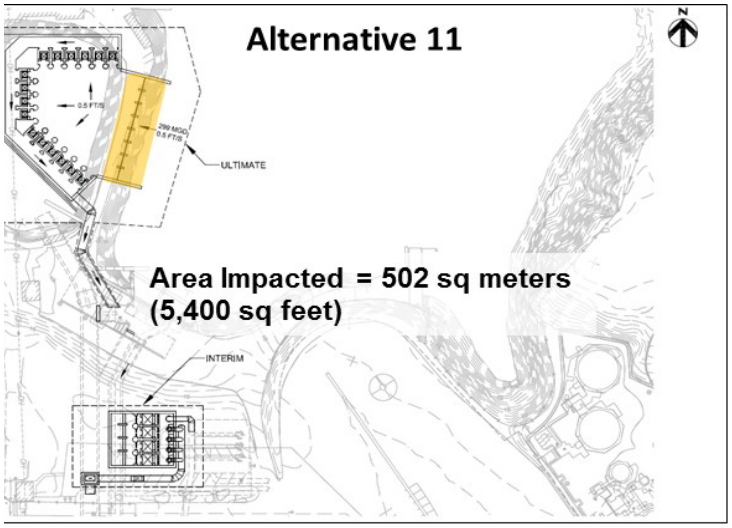


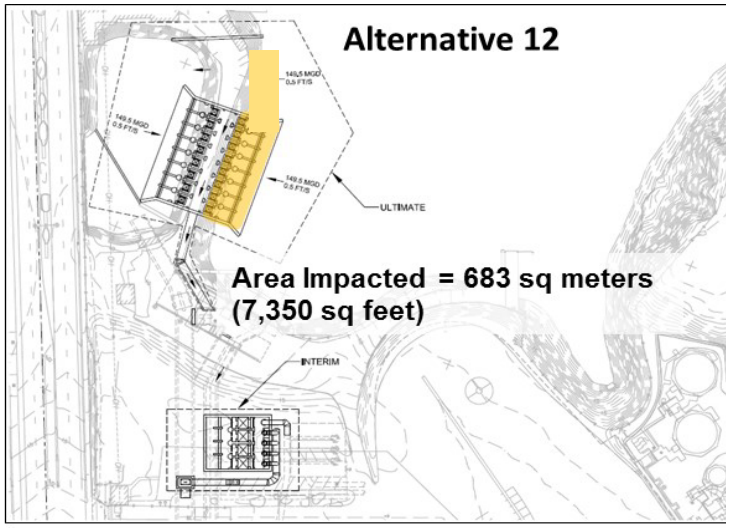
Proposed Intake Configuration

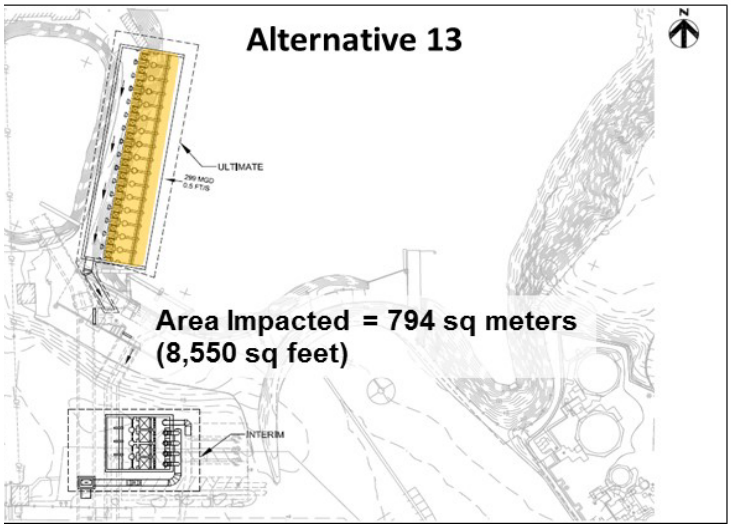
Construction Cost $42,216,844

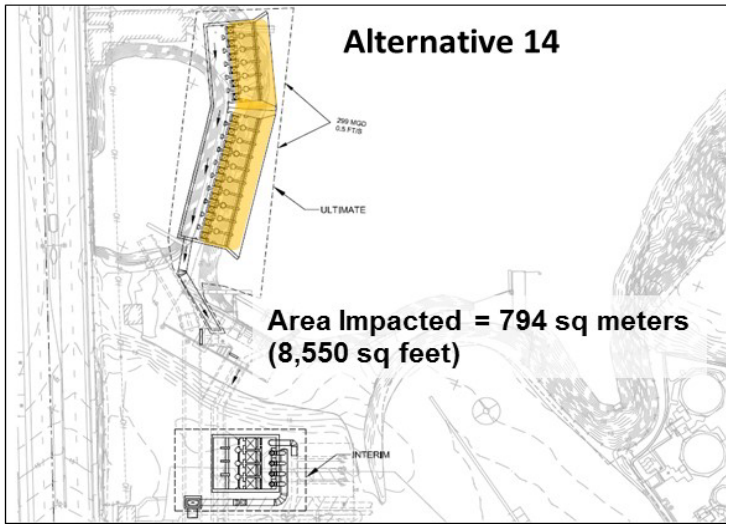
Fish Return Productivity Loss 1.1 lbs/day

Net Productivity Loss (excluding loss from Alternatives 11-14) 0.77 lbs/day to 0.89 lbs/day









Construction cost	**$111,108,000 to $113,428,000**
Increased Capital and Operating Cost	**$6,809,000/year to $7,059,000/year**
Permanent Productivity Loss	**0.20 lbs/day to 0.32 lbs/day**
Incremental Cost to Achieve Reduced Mortality	**$32,107/lb to $42,257/lb**

ANALYSIS OF ALTERNATIVE SCREEN LOCATIONS – SCHEDULE FOR COMPLETION OF IMPROVEMENTS

Approvals

Carlsbad Desalination Project

- Local
  - Water Purchase Agreement
  - NRG – Land Lease
  - CEQA
  - PDP
- State
  - State Lands Commission Lease
  - Drinking Water Permit
  - Coastal Development Permit
  - RWQCB Water Code Determination
- Federal
  - NPDES Permit

Intake System Modifications

- Local
  - Water Purchase Agreement Amendment
  - NRG – Land Lease Amendment
  - CEQA
  - PDP Amendment
- State
  - State Lands Commission Lease Amendment
  - Drinking Water Permit Amendment
  - CA Fish and Wildlife 1602 Streambed Alteration Agreement
  - Coastal development permit amendment
  - RWQCB Water Code Determination
- Federal
  - NPDES Permit Renewal
  - 401 Certification
  - NMFS/NOAA Take Permit
  - Army Corp of Engineers Section 404/Nationwide Permit

Additional Requirements Under Water Boards' Approach

- Two phases of permitting, engineering, financing and construction
- Additional permits required:
  - Army Corps 404, which would include a NMFS biological opinion
  - RWQCB 401 Water Quality Certification
  - CEQA and NEPA review
- Complex construction in marine wetlands

Construction Schedule

- Poseidon's proposal, or the first phase of the Water Boards' proposal
  - Complete permitting, 30% design, contractor selection, WPA revisions, and financing late 2017
  - Final engineering and construction 18 months
  - Improvements ready to go into service mid to 2019
- Second phase of Water Boards' proposal
  - Complete permitting, 30% design contractor selection, WPA revisions, and financing late 2019
  - Final engineering and construction 24 months
  - Improvements ready to go into service 2022

ANALYSIS OF ALTERNATIVE SCREEN LOCATIONS – COST OF IMPROVEMENTS

Comparison of Construction Cost for Alternative Screen Locations

Carlsbad Desalination Project Intake Alternatives Construction Cost Analysis ($)													
Construction Cost	Intake/Discharge Improvements with Through Screen Velocity 0.5 fps	Intake/Discharge with Velocity 0.5 fps All Locations											
Alternative	**Poseidon Feb 2016**	**11 - Screens Arranged Inside Discharge Pond**			**12 - Screen Oriented Back to Back**			**13 -Screens in Straight Alignment Along Pond**			**14 - Screens in Bent Alignment Along Pond**		
Improvement Phase	**NA**	**Interim**	**Final**	**Total**	**Interim**	**Final**	**Total**	**Interim**	**Final**	**Total**	**Interim**	**Final**	**Total**
Construction Costs		**18 month**	**24 month**		**18 month**	**24 month**		**18 month**	**24 month**		**18 month**	**24 month**	
Additional Permitting	3,150,000	3,150,000	2,000,000	5,150,000	3,150,000	2,000,000	5,150,000	3,150,000	2,000,000	5,150,000	3,150,000	2,000,000	5,150,000
Intake/Outfall Construction	30,168,966	23,183,000	63,714,000	86,897,000	23,183,000	62,585,000	85,768,000	23,183,000	62,267,000	85,450,000	23,183,000	64,408,000	87,591,000
Construction Management	1,728,298	2,400,000	3,000,000	5,400,000	2,400,000	3,000,000	5,400,000	2,400,000	3,000,000	5,400,000	2,400,000	3,000,000	5,400,000
Construction Insurance	1,000,000	Inc. Line 7	Inc. Line 7	Inc. Line 7	Inc. Line 7	Inc. Line 7	Inc. Line 7	Inc. Line 7	Inc. Line 7	Inc. Line 7	Inc. Line 7	Inc. Line 7	Inc. Line 7
Construction Rent	300,000	200,000	600,000	800,000	200,000	600,000	800,000	200,000	600,000	800,000	200,000	600,000	800,000
Post Construction Entrainment Study	1,200,000	-	1,200,000	1,200,000	-	1,200,000	1,200,000	-	1,200,000	1,200,000	-	1,200,000	1,200,000
Subtotal	**37,547,264**	**28,933,000**	**70,514,000**	**99,447,000**	**28,933,000**	**69,385,000**	**98,318,000**	**28,933,000**	**69,067,000**	**98,000,000**	**28,933,000**	**71,208,000**	**100,141,000**
Transaction Costs, legal	846,547	652,018	1,603,086	2,255,103	652,018	1,577,697	2,229,715	652,018	1,570,437	2,222,454	652,018	1,603,086	2,255,103
Capitalize Interest	1,820,236	1,408,624	4,314,390	5,723,014	1,408,624	4,245,053	5,653,677	1,408,624	4,225,101	5,633,725	1,408,624	4,297,040	5,705,664
Additional 6 Mo Debt Service Reserve	1,195,956	921,136	2,381,630	3,302,765	921,136	2,343,912	3,265,047	921,136	2,333,125	3,254,260	921,136	2,381,630	3,302,765
Debt Underwriting	347,084	267,327	657,265	924,592	267,327	646,856	914,183	267,327	643,879	911,206	267,327	657,265	924,592
Additional 1 month O&M Reserve	208,333	208,333	62,500	270,833	208,333	62,500	270,833	208,333	62,500	270,833	208,333	62,500	270,833
Outstanding Equity Fee	251,424	193,649	634,822	828,471	193,649	624,768	818,417	193,649	621,893	815,542	193,649	634,822	828,471
Total Project Cost	**42,216,844**	**32,584,088**	**80,167,692**	**112,751,780**	**32,584,088**	**78,885,786**	**111,469,874**	**32,584,088**	**78,523,934**	**111,108,022**	**32,584,088**	**80,844,342**	**113,428,430**
Incremental Increase				**70,534,936**			**69,253,030**			**68,891,178**			**71,211,586**

Benefit/Cost Analysis for Alternative Screen Locations

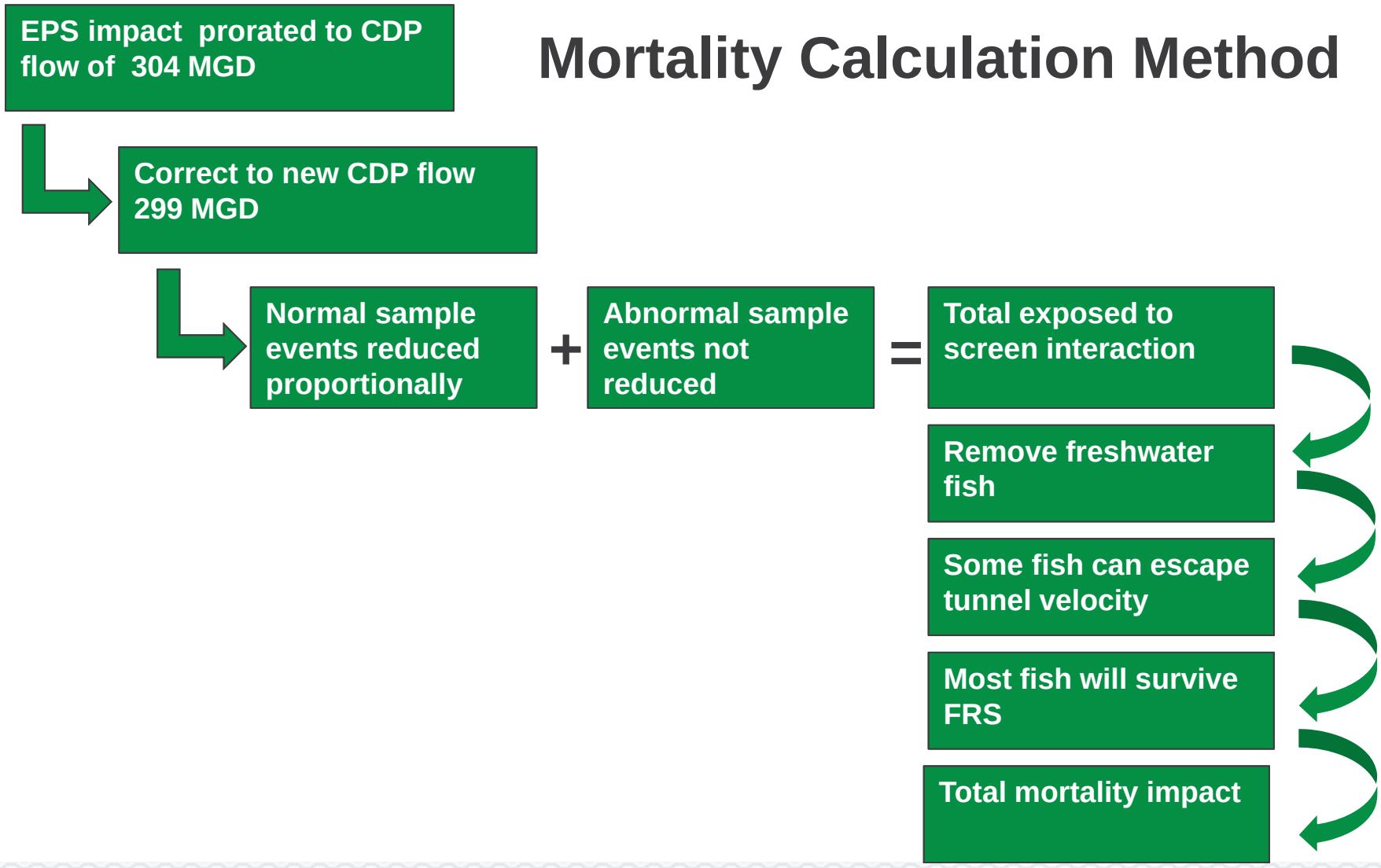
Carlsbad Desalination Project Intake Alternatives Annualized Cost Analysis													
Annual Cost	Intake/Discharge Improvements with Through Screen Velocity 0.5 fps	Intake/Discharge with Velocity 0.5 fps All Locations											
Alternative	Poseidon Feb 2016	1 - Screens Arranged Inside Discharge Pond			2 - Screen Oriented Back to Back			3 -Screens in Straight Alignment Along Pond Berm			4 - Screens in Bent Alignment Along Pond Bern		
Improvement Phase	NA	Interim	Final	Total	Interim	Final	Total	Interim	Final	Total	Interim	Final	Total
Annual Costs													
Construction Debt Charge	2,391,911	1,842,272	4,763,259	6,605,531	1,842,272	4,687,823	6,530,095	1,842,272	4,666,249	6,508,521	1,842,272	4,763,259	6,605,531
Construction Equity Charge	1,154,708	899,870	2,244,591	3,144,460	899,870	2,207,134	3,107,003	899,870	2,197,161	3,097,031	899,870	2,349,762	3,249,632
Additional O&M Charge	2,500,000	2,500,000	750,000	3,250,000	2,500,000	750,000	3,250,000	2,500,000	750,000	3,250,000	2,500,000	750,000	3,250,000
Total Annual Costs	**3,546,619**	**2,742,141**	**7,757,850**	**10,499,991**	**2,742,141**	**7,644,957**	**10,387,098**	**2,742,141**	**7,613,410**	**10,355,552**	**2,742,141**	**7,863,022**	**10,605,163**
Incremental Increase				**6,953,372**			**6,840,479**			**6,808,932**			**7,058,543**

Carlsbad Desalination Project Intake Alternatives Cost/Benefit Analysis													
Cost/Benefit Analysis	Intake/Discharge Improvements with Through Screen Velocity 0.5 fps	Intake/Discharge with Velocity 0.5 fps All Locations											
Alternative	Poseidon Feb 2016	1 - Screens Arranged Inside Discharge Pond			2 - Screen Oriented Back to Back			3 -Screens in Straight Alignment Along Pond Berm			4 - Screens in Bent Alignment Along Pond Bern		
Productivity Loss (kg/yr)	181			33.36			45.41			52.82			52.82
Net Productivity Loss Proposed Intake (kg/yr)				147.64			135.59			128.18			128.18
Net Productivity Loss Proposed Intake (lbs/d)				0.89			0.82			0.77			0.77
Incremental Cost increase ($/yr)				$6,953,371.79			$6,840,478.57			$6,808,932.13			$7,058,543.39
Unit Cost of Environmental Benefit ($/kg)				$47,096.80			$50,449.73			$53,120.08			$55,067.43
Unit Cost of Reduced Mortality ($/lb)				**$21,407.64**			**$22,931.69**			**$24,145.49**			**$25,030.65**

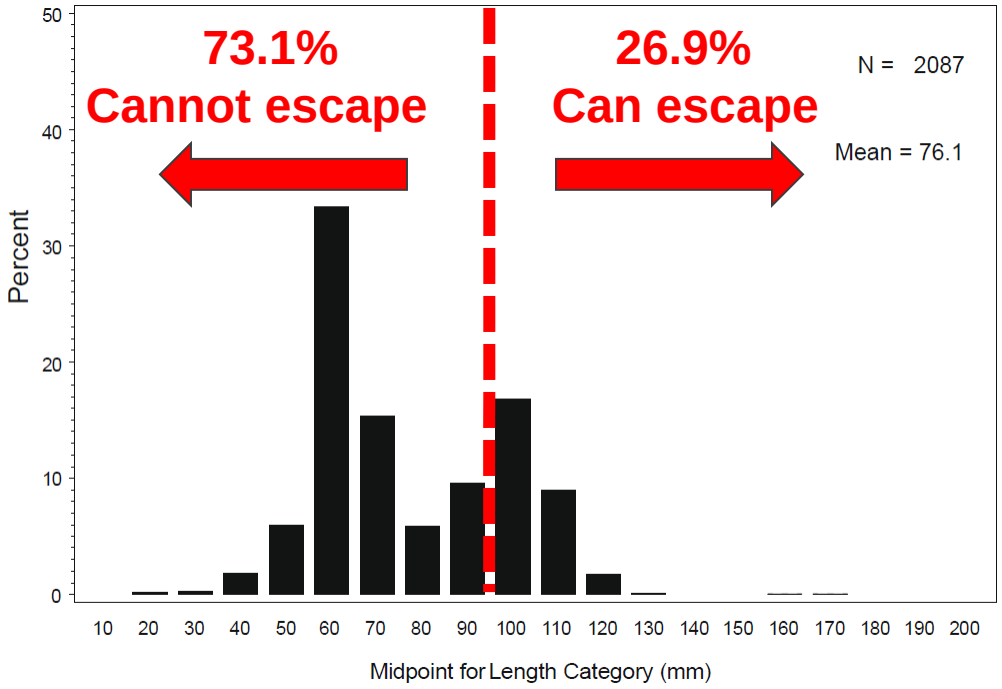
ANALYSIS OF ALTERNATIVE SCREEN LOCATIONS – MARINE LIFE MORTALITY COMPARISON BETWEEN THE PROPOSED SCREENING LOCATION AND THE LAGOON SCREEN LOCATIONS

Marine Life Mortality Comparison between the Proposed Screening Location and the Lagoon Screen Locations

Marine Life Mortality Comparison between the Proposed Screening Location and the Lagoon Screen Locations



Marine Life Mortality Comparison between the Proposed Screening Location and the Lagoon Screen Locations

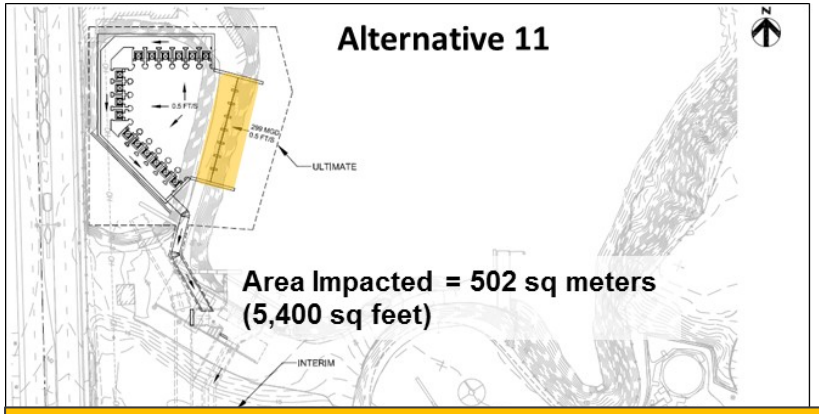


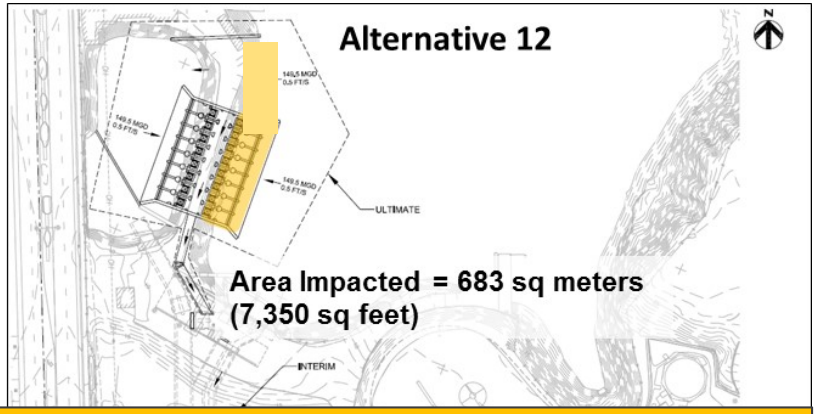
		Burst Swimming		
Midpoint of Length (cm) Categories	% Distribution	Mean (BL/sec)[1]	Mean (ft/sec)	Can escape ?
0.5	0	10	0.2	no
1.5	0.004	10	0.5	no
2.5	0.006	10	0.8	no
3.5	0.02	10	1.1	no
4.5	0.05	10	1.5	no
5.5	0.36	10	1.8	no
6.5	0.14	10	2.1	no
7.5	0.06	10	2.5	no
8.5	0.09	10	2.8	no
9.5	0.16	10	3.1	yes
10.5	0.08	10	3.4	yes
11.5	0.02	10	3.8	yes
12.5	0.004	10	4.1	yes
13.5	0	10	4.4	yes
14.5	0	10	4.8	yes
15.5	0.0025	10	5.1	yes
16.5	0.0025	10	5.4	yes
17.5	0	10	5.7	yes

Marine Life Mortality Comparison between the Proposed Screening Location and the Lagoon Screen Locations

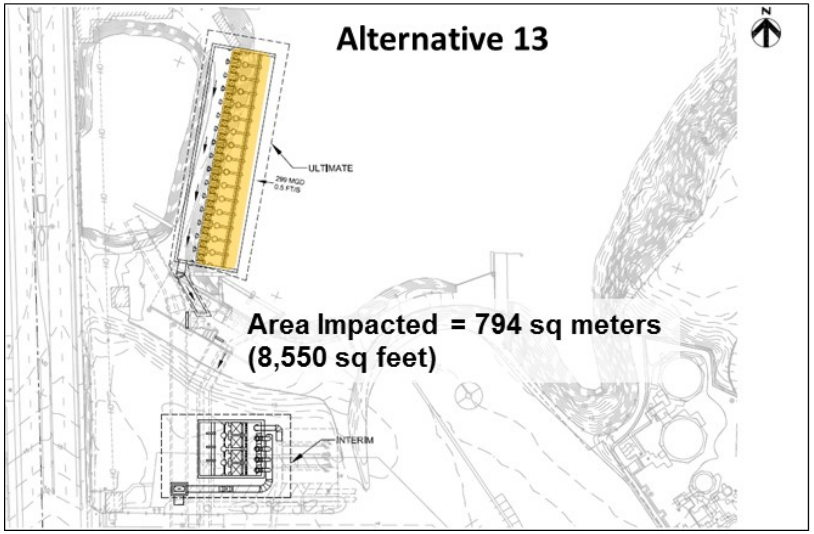
		Total 2004-2005		Total reductions flow and non flow events		Reduced by number that can escape based on swim speed		Number surviving fish return system (85% Survival or SONGS)[1]		Total Mortalities	
Common Name	CDP/EPS Flow	#	Wght (g)	#	Wght (g)	#	Weight (g)	#	Wght (g)	#	Wght (g)
Topsmelt	0.455	5,252	42,561	3,946	34,779	3,547	31,730	3,015	26,971	532	4,760
Shiner Surfperch	0.455	2,827	28,374	1,454	16,939	1,336	15,758	1,336	15,758		
Deepbody Anchovy	0.455	2,081	11,627	1,235	8,198	1,136	7,779	568	3,890	568	3,890
Queenfish	0.455	1,306	7,516	653	4,066	629	3,930	534	3,340	94	589
Salema	0.455	1,061	2,390	498	1,113	498	1,113	423	946	75	167
Slough Anchovy	0.455	1,056	3,144	963	2,917	963	2,917	963	2,917		
Silverside	0.455	999	4,454	455	2,027	455	2,027	386	1,723	68	304
Walleye Surfperch	0.455	606	23,983	546	22,341	494	20,279	494	20,279		
Northern Anchovy	0.455	537	786	249	372	249	372	242	362	7	10
California Grunion	0.455	489	2,280	223	1,038	223	1,038	189	882	33	156
Giant Kelpfish	0.455	344	2,612	159	1,255	159	1,255	159	1,255		
Spotted Sand Bass	0.455	303	4,604	284	3,684	251	3,289	214	2,796	38	493
Pacific Sardine	0.455	268	1,480	137	872	117	763	100	648	18	114
Spotfin Croaker	0.455	184	11,354	92	8,181	85	7,750	72	6,587	13	1,162
Barred Sand Bass	0.455	151	1,541	122	1,042	122	1,042	122	1,042		
California Butterfly Ray	0.455	147	61,019	67	27,770	67	27,770	57	23,604	10	4,165
White Surfperch	0.455	144	4,686	88	3,885	88	3,885	84	3,722	4	163
California Needlefish	0.455	135	6,025	62	2,791	62	2,791	53	2,372	9	419
Kelp Bass	0.455	111	680	95	320	95	320	95	320		
Specklefin Midshipman	0.455	103	28,189	47	13,116	47	13,116	40	11,148	7	1,967

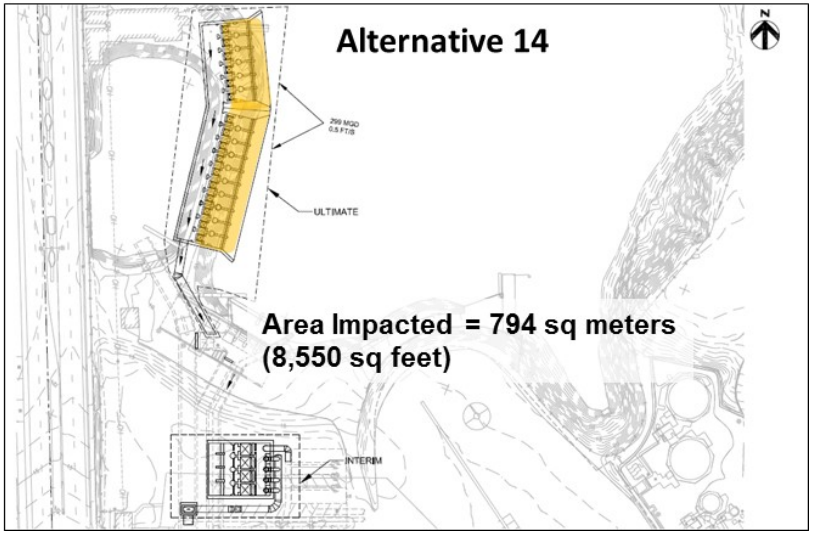
Marine Life Mortality Comparison between the Proposed Screening Location and the Lagoon Screen Locations





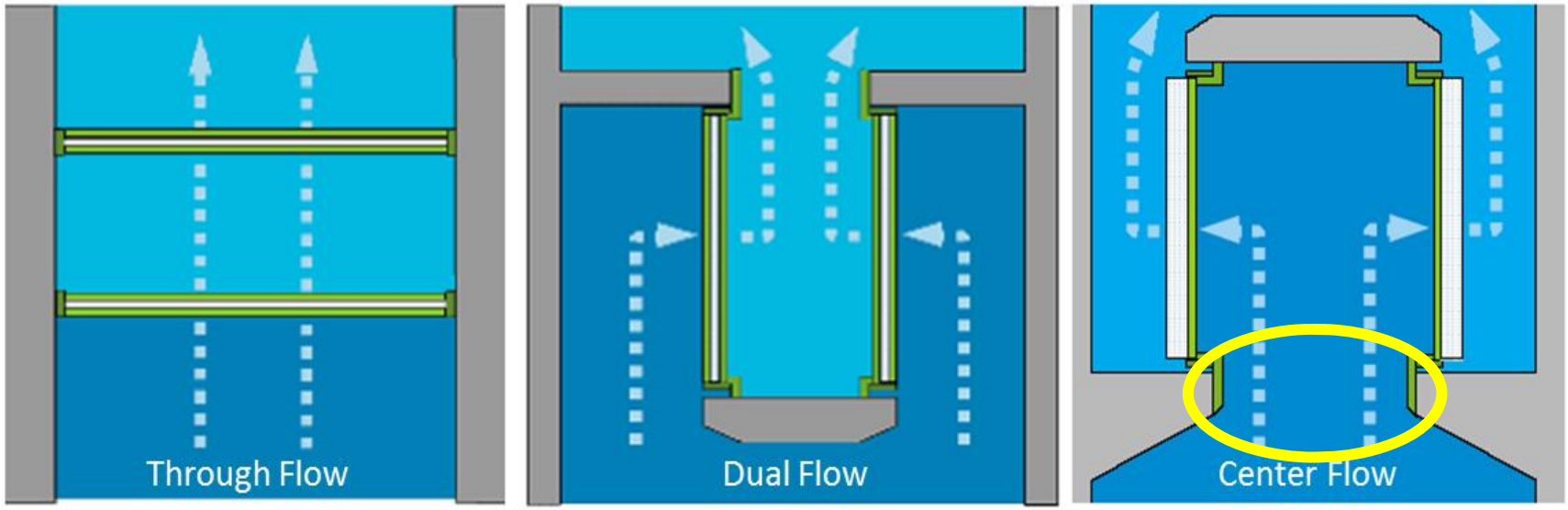
Note that the design has expanded from 8 to 16 screens to ensure that no velocity upstream of the screen face is above 0.5 ft/sec





Marine Life Mortality Comparison between the Proposed Screening Location and the Lagoon Screen Locations

Constriction at opening had higher velocities than through the screen



Marine Life Mortality Comparison between the Proposed Screening Location and the Lagoon Screen Locations

Intake alternative	Rirrap length (ft)	Width (ft)	Footpint area (ft^2)	Footprint area (m^2)	Productivy ($WWg/m^2/yr$)[1]	Lost fish biomass (WWg/yr)	Lost fish biomass (WWkg/yr)
1	180	30	5,400	502	66.5	33,361	33.36
2	245	30	7,350	683	66.5	45,409	45.41
3	285	30	8,550	794	66.5	52,822	52.82
4	285	30	8,550	794	66.5	52,822	52.82

[1] Productivity estimate from Johnson et al. 1994

ANALYSIS OF ALTERNATIVE SCREEN LOCATIONS – LAGOON FISH RETURN REQUIREMENTS

Lagoon Fish Return

Revised Permit Application Forms

- Revised Form 2D/Form 200 with new outfall designated “002”
- Supporting water quality table for fish return Outfall 002
- Fish return discharge location figure

Fish Return Antidegradation Analysis

- Fish return does not result in “lowering” of water quality
- “Complete” antidegradation analysis to be provided even though no lowering of water quality

ANALYSIS OF ALTERNATIVE SCREEN LOCATIONS – OCEAN PLAN VELOCITY REQUIREMENTS

Ocean Plan Requirement

OPA §M2d(1)(c)(iv):

> *In order to minimize impingement,* through-screen velocity *at the surface water intake shall not exceed [0.5 feet] per second.*

Through Screen Velocity

Through-screen velocity can only be measured at one location:

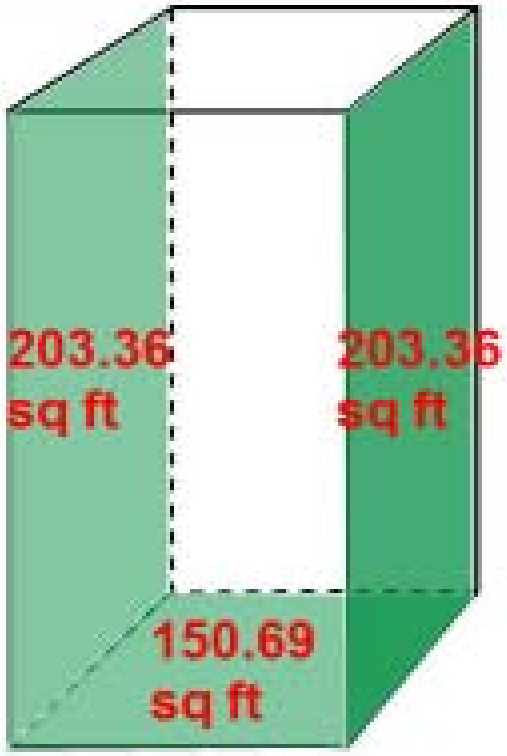
Through-screen velocity is the velocity that is measured through the screen face …

U.S. EPA Chapter 1 Economic and Engineering Analyses of the Proposed §316(b) New Facility Rule

Calculation of Through-Screen Velocity

Through-screen velocity= (intake flow) / (screen open area)

Description	Value	Unit
Total Flow Rate	299	MGD
Total Flow Rate	463	CFS
HWL	3.04	ft
LWL (MLLW)	-2.29	ft
Finished Floor	-20	ft
Depth HWL	23.04	ft
Depth LWL	17.71	ft
Channel Width	4.00	m
Channel Width	13.12	ft
Length	3.50	m
Length	11.48	ft
Surface Area Each Side Screen (Single Plane) HWL	264.57	ft²
Surface Area Each Side Screen (Single Plane) LWL	203.36	ft²
Surface Area Bottom Screen (Single Plane)	150.69	ft²
Total Screen Surface Area (Single Plane) HWL	679.83	ft²
Total Screen Surface Area (Single Plane) LWL	557.42	ft²
No. of Screens	6	-
Effective Open Area	0.37	-
Open Area Each Screen HWL	253.80	ft²
Open Area Each Screen LWL	208.10	ft²
Clean Velocity LWL	**0.37**	**ft/s**
15% Fouling Velocity LWL	**0.44**	**ft/s**



Total Surface Area per Screen = 557.42 sq ft

Total Open Area per Screen = 557.42 sq ft x 0.37 = 208.10 sq ft

Total Open Area per 6 Screens = 208.10 x 6 = 1248.6 sq ft

Staff Report/Substitute Environmental Documentation

§*8.3.1.2.2*

The State Water Board's OTC Policy also requires that through screen velocities must be limited to 0.5 fps … to reduce impingement

§*8.3.4:*

To address entrainment reductions for a surface intake, the through-screen velocity should not exceed 0.5 ft/sec as it has been demonstrated to protect most small fish and is an appropriate value to preclude most impingement of adult fish.

§*8.4.1:*

The U.S. EPA Phase I Rule can be used to inform board decisions about how to best address siting of desalination facilities

§ 8.3.1.2

refers to the 316(b) Rule for guidance on technologies to help reduce or avoid impingement and entrainment.

U.S. EPA 316(b) Rule

Under the 316(b) Rule a fish return is an acceptable technology to avoid entrapment and entrapment related impingement mortality:

> *Entrapment means the condition where impingeable fish and shellfish lack the means to escape the cooling water intake. Entrapment includes but is not limited to: Organisms caught in the bucket of a traveling screen and unable to reach a fish return; organisms caught in the forebay of a cooling water intake system without any means of being returned to the source waterbody without experiencing mortality; or cooling water intake systems where the velocities in the intake pipes or in any channels leading to the forebay prevent organisms from being able to return to the source waterbody through the intake pipe or channel.*

Response to Comments

Comment 13.91: *To accurately and completely inform the Board and the public, the phrase 'allows for no impingement' should be replaced with 'requires an intake velocity of 0.5 feet per second or less' …*

Staff Response: *The swim speed studies conducted by U.S. EPA are used in several federal regulations, including the U.S. EPA 316(b) rule making as the basis for determining that a 0.5 fps through-screen velocity will reduce impingement. The through-screen velocity standard of 0.5 fps is also used in the OTC Policy.*

Water Code Section 13142.5(b)

The velocity requirement in the OPA is implementing a provision in Water Code Section 13142.5(b) which states:

> *"… the best available site, design, technology, and mitigation measures feasible shall be used to minimize the intake and mortality of all forms of marine life."*

Staffs' interpretation of the OPA removes the feasibility consideration from the decision making process.

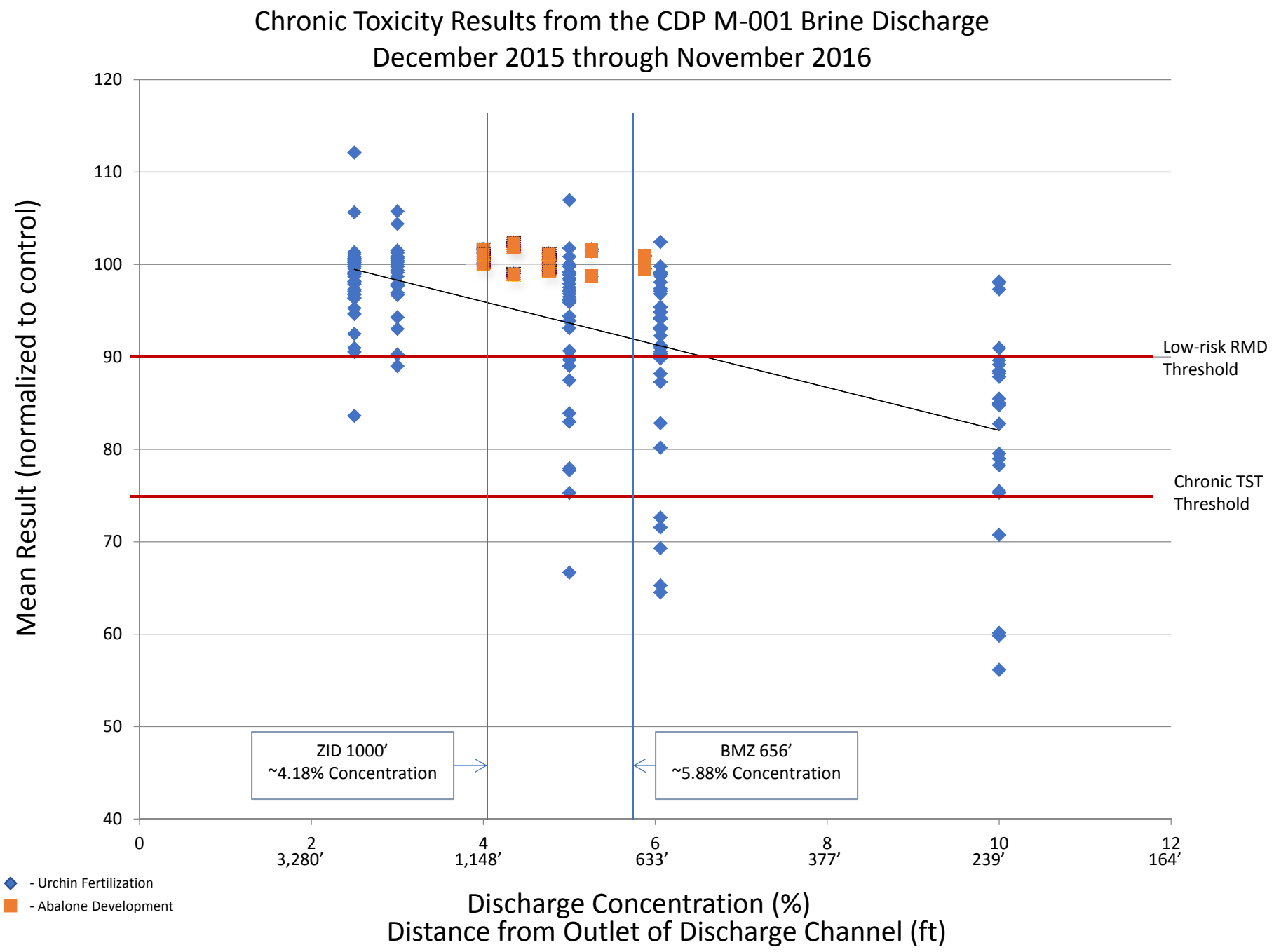
Conclusions

- The Legislature has not granted the State Water Board the authority to remove the feasibility consideration from the OPA decision making process.

- The only reasonable interpretation of the OPA, Staff Report, Response to Comments, and State Water Board's reliance on the OTC Policy and 316(b) Rule is that the State Water Board only intended to regulate the velocity of the seawater as it passes through the screens.

ZONE OF INITIAL DILUTION

Zone of Initial Dilution (ZID)


Chronic Toxicity Results from the CDP M-001 Brine Discharge
December 2015 through November 2016
Mean Result (normalized to control)
120
110
100
90
80
70
60
50
40
Low-risk RMD Threshold
Chronic TST Threshold
ZID 1000'
~4.18% Concentration
BMZ 656'
~5.88% Concentration
0
2
3,280'
4
1,148'
6
633'
8
377'
10
239'
12
164'
- Urchin Fertilization
- Abalone Development
Discharge Concentration (%)
Distance from Outlet of Discharge Channel (ft)

ZID Location

- One of the objectives in determining the locations of the ZID is that the ZID is no bigger than necessary to ensure compliance with the effluent limit for chronic toxicity and the Ocean Plan Table 1 Water Quality Objectives.
- Based on initial dilution modeling and chronic toxicity test results, the Discharger is conditionally recommending that the ZID remain at its current location 1,000 feet offshore.
- At this location a concentration of brine to seawater of 4.18% would be achieved with a combined discharge of 238 MGD consisting of 62 to 68 MGD of filter backwash and RO brine and 170 to 176 MGD of flow augmentation.
- The discharge would result in a salinity of 42 ppt in the discharge pond (Effluent Monitoring Location M-002).

ZID Location

- The CDP has only been in operation for one year.
- There is no data available for a 4.18% concentration.
- A concentration of 4.18% is approximately halfway between 3% concentration that consistently passes the TST test and the 5% concentration that periodically fails the TST test.
- There remains some uncertainty as to whether the CDP will be able to reliably meet the chronic toxicity effluent limit with a ZID located 1,000’ offshore of the discharge channel.
- However, there are ways to manage this uncertainty.

Managing the Uncertainty with the Proposed ZID Location

The Discharger is requesting the Regional Water Board include the following conditions in the revised permit to assist with the management of this uncertainty associated with the proposed ZID location.

1. The chronic toxicity sample would be collected an M-002 to account for flow augmentation.
2. The chronic toxicity test requirements would follow the TST testing protocol.
3. The revised Order would allow the quantity of water used for flow augmentation to be adjusted within reasonable limits.
4. The revised Order would provide that to the extent that new information becomes available, the permit may be reopened to re-evaluate the chronic toxicity monitoring compliance methodology and/or the initial dilution and the location of the edge of the ZID.

ZID Location

Table 1 Summary of CDP Intake, Production and Discharge Flows CDP Typical Operating Conditions During Permanent Stand-Alone Operation			
Parameter		Permanent Stand-Alone Operating Conditions	
Potable Water Production		50 MGD	60 MGD
Intake Flows	Intake Lagoon	Up to 299 MGD	299 MGD
Discharge Flows	Filter Backwash and RO Brine (discharge to Pacific Ocean)	52 to 58 MGD	62 to 68 MGD
	Screen Wash/Fish Return (discharge to lagoon)	1 MGD	1 MGD
	Flow Augmentation (discharge to Pacific Ocean)	140 to 196 MGD[1]	170 to 176 MGD
	Total Discharge to Pacific Ocean	192 to 248 MGD	238 MGD
Salinity	Natural Background Salinity (average)	33.5 ppt	33.5 ppt
	Discharge Pond Salinity	40 ppt to 42 ppt[2]	42 ppt

MITIGATION - BRINE DISCHARGE MORTALITY CALCULATIONS

Brine Discharge Mortality Calculations

Take Home Points

1. ETM/APF is appropriate model for assessing mortality of organisms in entrained ambient flow
2. Impacts are related to:
    1. Construction – area of permanent habitat loss
    2. Operation (BMZ) – area in which salinity exceeds 2 ppt above ambient
    3. Operation (flow augmentation) – proportional mortality via ETM
3. BMZ mitigation should not be required due to overlap in source water bodies (flow aug)

1. Construction Impacts

Impacts	Intake Water Potentially Exposed to 100% Mortality	Flow Augmentation Water Potentially Exposed to 100% Mortality	Diffuser Water Potentially Exposed to 100% Mortality	Total Water Potentially Exposed to 100% Mortality	Area of Production Foregone	Brine Mixing Zone @ 35.5 ppt	Permanent Construction Impacts to Marine Environment	Total Area Impacted	Marine Life Mortality Ranking
Alternatives	MGD	MGD	MGD	MGD	Acres	Acres	Acres	Acres	Ranked Lowest to Highest
Surface Screened Intake with Flow Augmentation	128	171	0	299	84.3	15.5	0	99.8	3
Surface Screened Intake with Multiport Diffuser	128	0	217	345	103.3		1.5	118.9	7
Subsurface Intake with Flow Augmentation	0	0	0	0	0	15.5	72	87.5	1
Subsurface Intake with Multiport Diffuser	0	0	217	217	67	14.4	33	114.4	6
Offshore Wedgewire Screen with Flow Augmentation	127	171	0	298	92	15.5	2.06	109.5	5
Offshore Wedgewire Screen with Diffuser	127	0	217	344	106.2	14.4	2.5	123.1	10
Lagoon Wedgewire Screen with Flow Augmentation	127	171	0	298	84	15.5	0.1	99.6	2
Lagoon Wedgewire Screen with Diffuser	127	0	217	344	103	14.4	1.6	119.0	8
Lagoon Traveling Screen with Flow Augmentation	128	171	0	299	84.3	15.5	0.1	99.9	4
Lagoon Traveling Screen with Diffuser	128	0	217	345	103.3	14.4	1.6	119.3	9

2. Operational Impacts - BMZ

Impacts	Intake Water Potentially Exposed to 100% Mortality	Flow Augmentation Water Potentially Exposed to 100% Mortality	Diffuser Water Potentially Exposed to 100% Mortality	Total Water Potentially Exposed to 100% Mortality	Area of Production Foregone	Brine Mixing Zone @ 35.5 ppt	Permanent Construction Impacts to Marine Environment	Total Area Impacted	Marine Life Mortality Ranking
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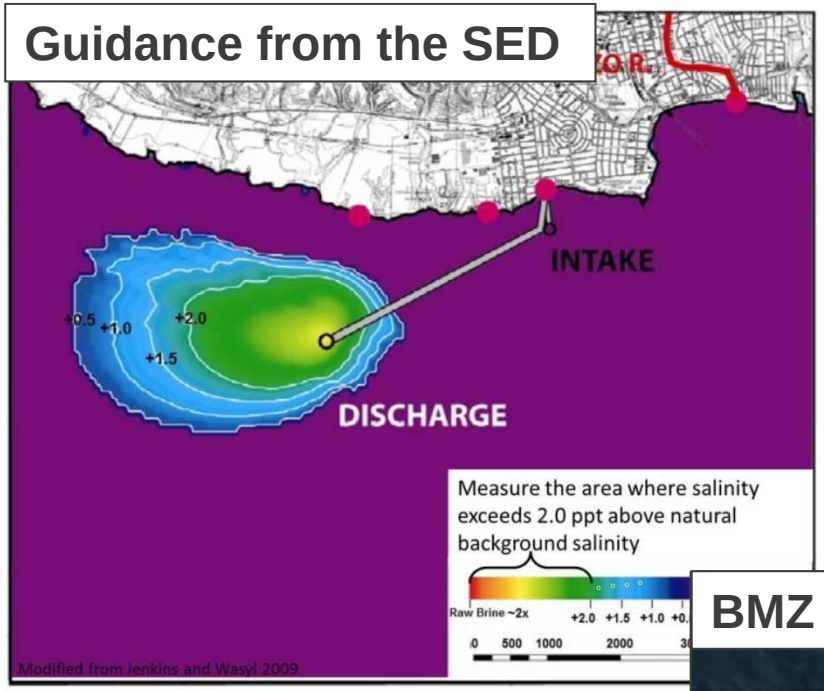
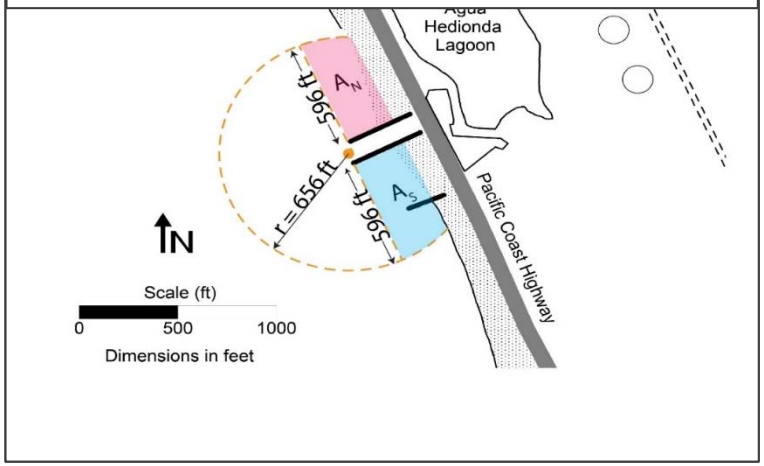
2. Operational Impacts - BMZ

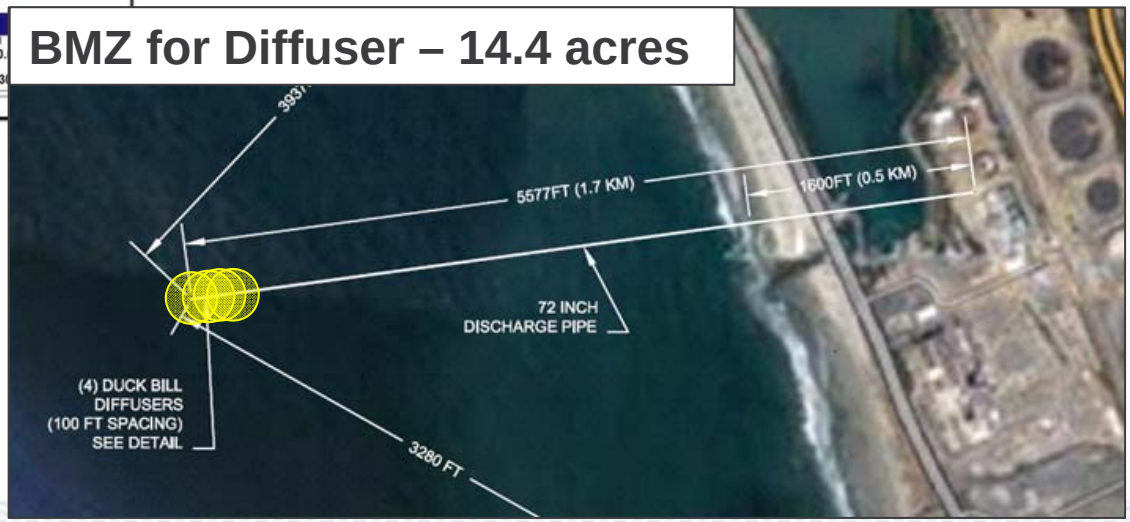
Guidance from the SED



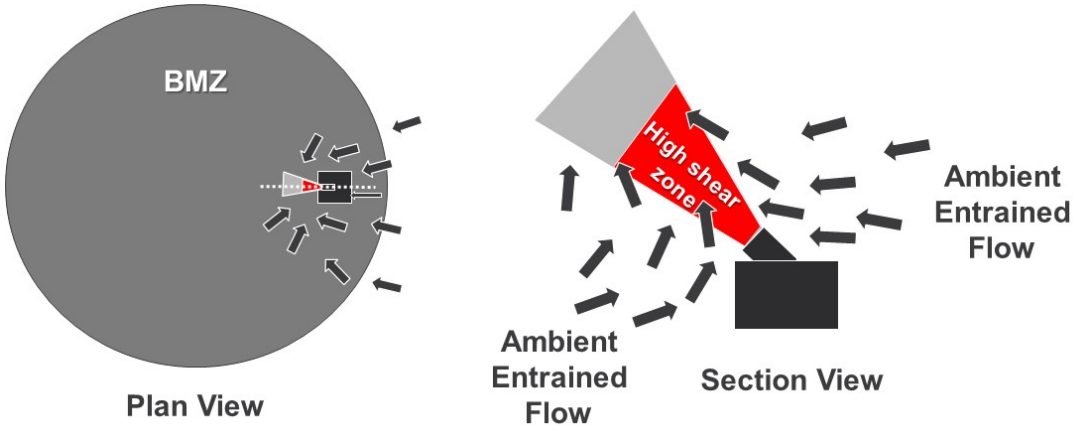
BMZ for Flow Aug – 18.5 acres

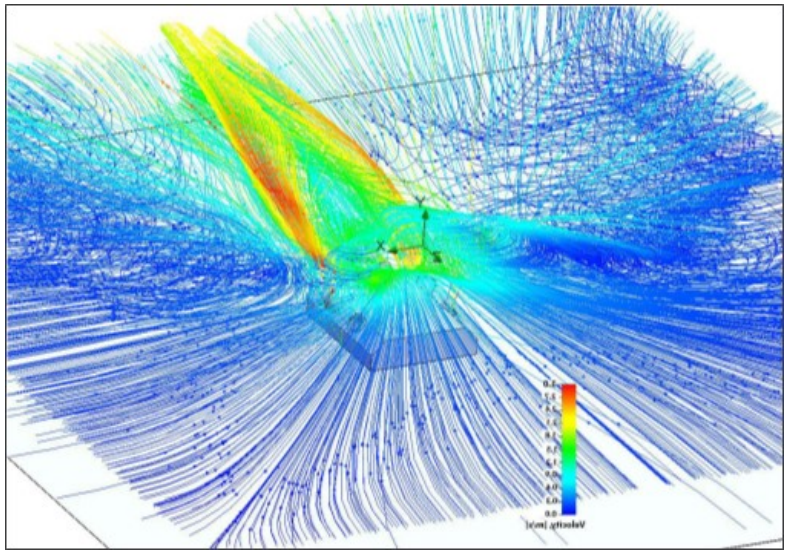


BMZ for Diffuser – 14.4 acres



3. Operational Impacts – Diffuser and Flow Aug





- Since the diffuser source water body would overlap with the BMZ source water body, mitigating for BMZ would be duplicative
- Since the flow augmentation source water body would overlap with the BMZ source water body, mitigating for BMZ would be duplicative

3. Operational Impacts – Diffuser

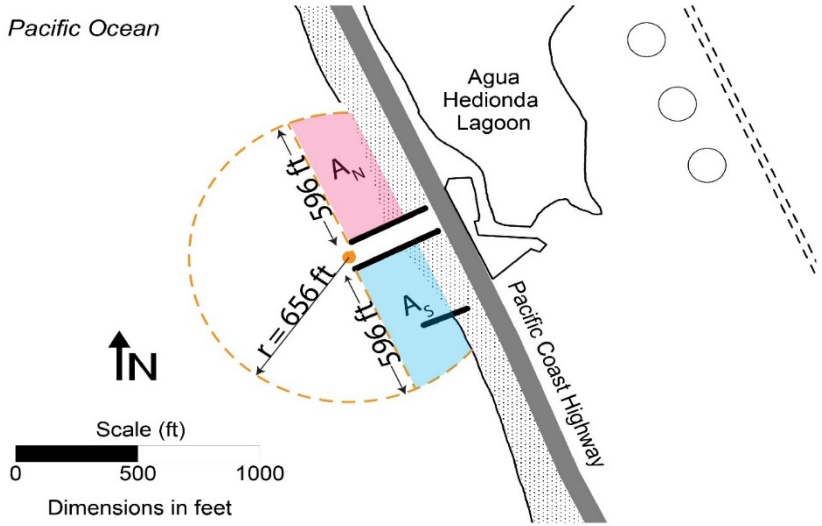
- 945 MGD of ambient seawater required to dilute 67 MGD brine (65 ppt) to 35.5 ppt (2 ppt above ambient)
- 23% of 945 MGD = 217 MGD
- APF = 67 acres for lethal shear associated with 217 MGD

Operational Impacts – Flow Augmentation and Diffuser

Flow Aug Alternative	Diffuser Alternative
Dilution flow entrainment	High shear
BMZ	BMZ
Intake entrainment	Intake entrainment
No BMZ since its source water body overlaps with flow source water	No BMZ since its source water body overlaps with source water supplying the high shear area

MITIGATION AND CLIMATE CHANGE – EFFECT OF SEA LEVEL RISE ON BMZ MITIGATION AREA

BMZ Current and 2065 Habitat Area



Brine Mixing Zone				
Current and Year 2065 Area				
		Current Area (Acres)	2065 Area (Acres)	Increase (Acres)
BMZ Area	Seaward of Discharge Point	15.51	15.51	0
	Shoreward of Discharge Point	3.01	3.89	0.88
	Total	18.52	19.40	0.88

Brine Mixing Zone				
Current and Year 2065 Area By Habitat Type				
		Current Area (Acres)	2065 Area (Acres)	Increase (Acres)
BMZ Area	Soft Bottom Habitat	18.2	19.01	0.81
	Rocky Habitat North and South Jetties	0.31	0.39	0.08
	Total	18.51	19.40	0.89

Wetlands Restoration Project Current and 2065 Habitat Area

Wetlands Restoration Project Current and Year 2065 Area				
		Current Area (Acres)	2065 Area (Acres)	Increase (Acres)
Wetlands Restoration Project Alternative	Intertidal Alternative	112.9	113.67	0.69
	Subtidal Alternative	109.11	112.65	3.54
	Average	111.01	113.16	2.12

Effect of Sea Level Rise on BMZ Mitigation Area

The area within the BMZ is expected to increase by 0.89 acre by the year 2065.

The area within the wetlands restoration project is expected to increase by at least 0.69 acre during the same period.

After adjusting the increased area in the wetlands project by the applicable mitigation ratio, the additional mitigation required within the BMZ due to sea level rise is fully offset by the increased area within the wetland project.

Brine Mixing Zone							
Habitat Mitigation Requirements Due to Sea Level Rise							
	A	B	C		D	E	F
	BMZ Current Area (Acres)	BMZ 2065 Area (Acres)	BMZ Increased Area (Acres)	Lower Bound of Expected Wetlands Area Increase (Acres)	Applicable Mitigation Ratio	Relative Productivity of Wetlands Increase (Acres)	Additional Mitigation Required in BMZ that is not Offset by Wetlands Area Increase (Acres)
Soft Bottom Habitat	18.2	19.01	0.81	0.61	10:1	6.10	0
Rocky Habitat North and South Jetties	0.31	0.39	0.08	0.08	1:1	0.08	0
Total	18.51	19.40	0.89	0.69			0